

**Multiplier VCXO IC Die for 12 to 25MHz Parallel Resonant Crystals**

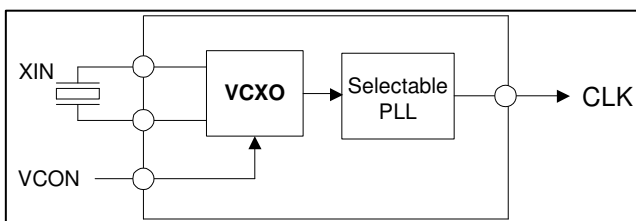
**FEATURES**

- Integrated voltage-controlled crystal oscillator circuitry (VCXO) (pull range 500ppm minimum).
- Low phase noise (-125dBc @ 10kHz offset and 155.52MHz output)
- Selectable frequency multipliers (x1, x2, x4, x8).
- 3.3V supply voltage.
- Uses inexpensive fundamental-mode parallel resonant crystals (from 12 to 25MHz).
- Selectable High Drive (30mA) or Standard Drive (10mA) output.
- Available in DIE (65 mil x 62 mil).

**DESCRIPTION**

The PL502-00 is a monolithic low jitter and low phase noise (-125dBc @10kHz offset and 155.52MHz output), high performance CMOS VCXO IC Die, that uses a low cost crystal (12-25MHz). The same die can be used as a VCXO with output frequencies ranging from  $F_{XIN} \times 1$  to  $F_{XIN} \times 8$  using selector pad bonding options (see Multiplier Selection Table on this page). This makes the PL502-00 ideal for a wide range of applications from 12MHz to 190MHz (including 27MHz, 35.328MHz, 77.76MHz and 155.52MHz, etc.).

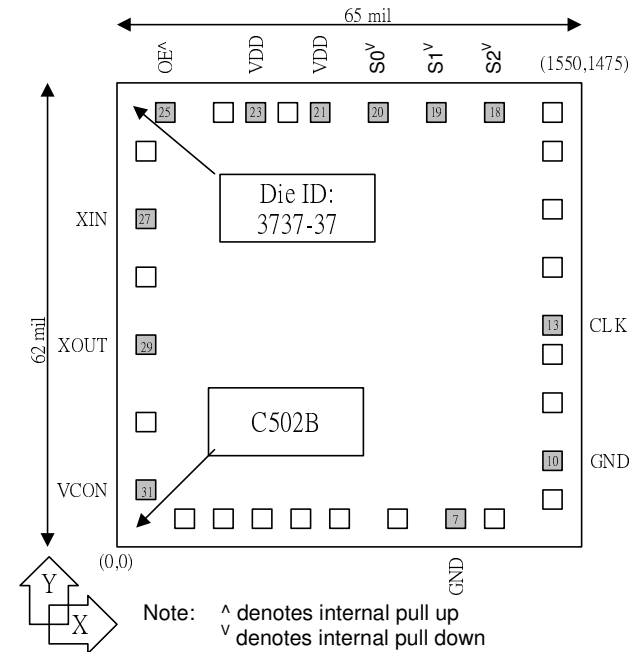
**BLOCK DIAGRAM**



**DIE SPECIFICATIONS**

Name	Value
Size	65 x 62 mil
Reverse side	GND
Pad dimensions	80 micron x 80 micron
Thickness	8 mil

**DIE CONFIGURATION**



**MULTIPLIER SELECTION**

SELECTION			$F_{XIN}$	CLK (MHz)
S2	S1	S0		
0	0	0	12MHz – 25MHz	$F_{XIN} \times 2$
0	0	1		$F_{XIN} \times 4$
0	1	0		$F_{XIN} \times 1$
0	1	1		$F_{XIN} \times 2^*$
1	0	0		$F_{XIN} \times 8$
1	0	1		$F_{XIN} \times 1^*$
1	1	0		$F_{XIN} \times 4^*$
1	1	1		$F_{XIN} \times 8^*$

Note: - Selector pads default to '0', wire bond to VDD to set to '1'  
- (\*) High-drive output

**PAD DESCRIPTION**

Name	Number	Description
XIN	27	Crystal input connection.
XOUT	29	Crystal output connection.
VCON	31	Voltage Control Input.
GND	7,10	Ground.
CLK	13	Clock Output.
S[0:2]	18,19,20	Frequency selection pads
VDD	21,23	3.3V Power Supply.
OE	25	Output Enable: '0' to disable (tri-state output), '1' (default value when not connected) to enabled the output.

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**ELECTRICAL SPECIFICATIONS**
**1. Absolute Maximum Ratings**

PARAMETERS	SYMBOL	MIN.	MAX.	UNITS
Supply Voltage	$V_{DD}$		4.6	V
Input Voltage, dc	$V_I$	-0.5	$V_{DD}+0.5$	V
Output Voltage, dc	$V_O$	-0.5	$V_{DD}+0.5$	V
Storage Temperature	$T_S$	-65	150	°C
Ambient Operating Temperature*	$T_A$	-40	85	°C
Junction Temperature	$T_J$		125	°C
Lead Temperature (soldering, 10s)			260	°C
ESD Protection, Human Body Model			2	kV

Exposure of the device under conditions beyond the limits specified by Maximum Ratings for extended periods may cause permanent damage to the device and affect product reliability. These conditions represent a stress rating only, and functional operations of the device at these or any other conditions above the operational limits noted in this specification is not implied.

\* **Note:** Operating Temperature is guaranteed by design for all parts (COMMERCIAL and INDUSTRIAL), but tested for COMMERCIAL grade only.

**2. DC Electrical Specifications**

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Supply Current, Dynamic, with Loaded Outputs	$I_{DD}$	$F_{XIN} = 12 - 25\text{MHz}$ Output load of 10pF			35	mA
Operating Voltage	$V_{DD}$		2.97		3.63	V
Output drive current (High Drive)	$I_{OH}$	$V_{OH} = V_{DD} - 0.4\text{V}$ , $V_{DD} = 3.3\text{V}$	30			mA
	$I_{OL}$	$V_{OL} = 0.4\text{V}$ , $V_{DD} = 3.3\text{V}$	30			mA
Output drive current (Standard Drive)	$I_{OH}$	$V_{OH} = V_{DD} - 0.4\text{V}$ , $V_{DD} = 3.3\text{V}$	10			mA
	$I_{OL}$	$V_{OL} = 0.4\text{V}$ , $V_{DD} = 3.3\text{V}$	10			mA
VCXO Control Voltage	VCON		0		3.3	V

**3. AC Electrical Specifications**

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Input Crystal Frequency			12		25	MHz
Output Clock Rise/Fall Time (Standard Drive)		0.3V ~ 3.0V with 15 pF load		3.0		ns
Output Clock Rise/Fall Time (High Drive)		0.3V ~ 3.0V with 15 pF load		1.2		
Output Clock Duty Cycle		Measured @ 50% $V_{DD}$	45	50	55	%

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### 4. Voltage Control Crystal Oscillator

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
VCXO Stabilization Time *	T <sub>VCXOSTB</sub>	From power valid			10	ms
VCXO Tuning Range		F <sub>XIN</sub> = 12 – 25MHz; XTAL C <sub>0</sub> /C <sub>1</sub> < 250 0V ≤ VCON ≤ 3.3V		500		ppm
CLK output pullability		VCON=1.65V, ±1.65V	±200			ppm
VCXO Tuning Characteristic				150		ppm/V
Pull range linearity					10	%
VCON pin input impedance			2000			kΩ
VCON modulation BW		0V ≤ VCON ≤ 3.3V, -3dB	10			kHz

**Note:** Parameters denoted with an asterisk (\*) represent nominal characterization data and are not production tested to any specific limits.

### 5. Crystal Specifications

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Crystal Resonator Frequency	F <sub>XIN</sub>	Parallel Fundamental Mode	12		25	MHz
Crystal Loading Rating	C <sub>L</sub> (xtal)	At VCON = 1.65V		9.5		pF
Crystal Pullability	C <sub>0</sub> /C <sub>1</sub> (xtal)	AT cut			250	-
Recommended ESR	R <sub>E</sub>	AT cut			30	Ω

**Note:** Crystal Loading rating: 9.5pF is the loading the crystal sees from the VCXO chip at VCON = 1.65V. It is assumed that the crystal will be at nominal frequency at this load. If the crystal requires more load to be at nominal frequency, the additional load must be added externally. This however may reduce the pull range.

### 6. Jitter and Phase Noise specification\*

PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNITS
RMS Period Jitter (1 sigma – 1000 samples)	at 155MHz, with capacitive decoupling between VDD and GND.		20		ps
Phase Noise relative to carrier Carrier Frequency 44MHz	@100Hz offset		-113		dBc/Hz
	@1kHz offset		-130		dBc/Hz
	@10kHz offset		-135		dBc/Hz
	@100kHz offset		-128		dBc/Hz
	@1MHz offset		-128		dBc/Hz
Phase Noise relative to carrier Carrier Frequency 155.52MHz	@100Hz offset		-100		dBc/Hz
	@1kHz offset		-115		dBc/Hz
	@10kHz offset		-125		dBc/Hz
	@100kHz offset		-116		dBc/Hz
	@1MHz offset		-114		dBc/Hz
	@10MHz offset		-132		dBc/Hz
	@40MHz offset		-142		dBc/Hz

\* General condition: Control Voltage is 0V.

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**PAD ASSIGNMENT**

Pad #	Name	X (μm)	Y (μm)	Description
7	GND	1042	109	Ground.
10	GND	1400	259	Ground.
13	CLK	1400	716	CMOS Clock Output.
18	S2	1232	1365	Used to select multiplication factor and Standard or High-Drive output. Internal pull down.
19	S1	1042	1365	Used to select multiplication factor and Standard or High-Drive output. Internal pull down.
20	S0	854	1365	Used to select multiplication factor and Standard or High-Drive output. Internal pull down.
21	VDD	659	1365	3.3V Power Supply.
23	VDD	459	1365	3.3V Power Supply.
25	OE	194	1365	Used to Enable/Disable the output. Internal pull up. See
27	XIN	109	1017	Crystal input. See Crystal Specifications on page 3.
29	XOUT	109	646	Crystal output. See Crystal Specifications on page 3.
31	VCON	109	181	Voltage Control Input. 0V to 3.3V.

**ORDERING INFORMATION**

**For part ordering, please contact our Sales Department:**

2880 Zanker Road, San Jose, CA 95134  
Tel (408) 571-1668 Fax (408) 571-1688

**PART NUMBER**

The order number for this device is a combination of the following:  
Device number, Package type and Operating temperature range

**PL502-00 D C**

PART NUMBER

TEMPERATURE  
C=COMMERCIAL  
I=INDUSTRIAL

PACKAGE TYPE  
D=DIE  
W=SAW WAFER IN BLUE TAPE

**Order Number**

**Marking**

**Package Option**

PL502-00DC

N/A

Die (Waffle Pack)

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